E298A/EECS290B Problem Set 4 (due 4/21/05)

1. Plot the Debye length, λ_D, and plasma frequencies, ω_e and ω_i, as a function of the number of ions/electrons per cm^3 over the range $10^2 - 10^{12} cm^{-3}$. You may assume an Ar plasma with ions singly charged.

2. Plot the mean electron velocity over the same parameter range.

3. Given an isotropic neutral atom flux distribution, with F_0 the flux received at a plane surface, calculate the flux and position dependent flux distribution across the bottom of an infinitely long rectangular cross section trench as a function of trench aspect ratio.

4. Calculate the average flux at the bottom of the trench as a function of aspect ratio.

5. Using the expression derived in problem 4, plot the average etching rate at the bottom of the trench for values of *r* of 0.01 to 0.5 assuming that the etch rate of a planar surface can be expressed as

$$E_0 \propto \frac{cI}{1+r}, \quad r = \frac{cI}{sF_0}$$

I is the ion flux, F_0 is the neutral atom flux, *c* is a reaction coefficient and *s* is the sticking coefficient.

6. Describe a potential etch chemistry and etch condition for etching Mo, and explain your choices.